Before the
Federal Communications Commission
Washington, D.C. 20554

In the matter of	)	
	)	
Establishment of an Interference Temperature	)	
Metric to Quantify and Manage Interference and	)	ET Docket No. 03-237
to Expand Available Unlicensed Operation in	)	
Certain Fixed, Mobile, and Satellite Frequency	)	
Bands	)	

To: The Commission

Reply Comments of American Electric Power Service Corporation

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Reply Comments of American Electric Power Service Corporation
on
Notice of Inquiry and
Notice of Proposed Rulemaking

American Electric Power Service Corporation (AEP) [1] hereby submits these reply comments in the above-captioned proceeding.

A. Summary

AEP has a large installed base of fixed service (FS) licensed systems operating in the 6 GHz band, including systems operating in the 6525-6700 MHz sub-band for which the Commission, in its Notice of Proposed Rulemaking (NPR) in this proceeding, has proposed to take an interference temperature approach. AEP also has a large installed base of fixed unlicensed devices operating in the 2.4 GHz and 5.8 GHz bands.

AEP is extremely concerned with the FCC's Interference Temperature Metric approach to spectrum allocation. The rules proposed in the NPR in particular pose an unnecessary risk of interference to AEP's

[1] American Electric Power Service Corporation ('AEPSC') is one of a family of companies that, in the interest of simplicity, are referred to collectively herein as 'AEP.' AEPSC holds most of the FCC licenses that are used in connection with American Electric Power's electric business operations.

fixed, licensed 6 GHz terrestrial systems, as well as those of other critical infrastructure licensees. The NPR, moreover, lacks enforceable mitigation procedures in the event that unlicensed operators interfere with licensed systems.

In addition, interference temperature monitoring equipment does not currently exist and, even if it did exist, many questions would remain as to the feasibility of deploying such equipment. The Commission's underlying assumptions regarding the absence of potential for interference by unlicensed transmitters with licensed paths employing fixed, high gain antennas are not valid. The FCC's target of the 6525-6700 MHz band as a test bed for unlicensed devices demonstrates that the Commission lacks appreciation for the role licensed 6 GHz systems play in the nation's critical infrastructure. Due to the overwhelming objection to the interference temperature concept by licensees, equipment manufacturers, and other affected entities, as evidenced by the initial comments to the NPR, and due to the points raised herein, AEP respectfully requests that the Commission terminate the NPR without further action.

Licensees in the 6525–6700 MHz band such as AEP constructed their systems and developed businesses around those systems in reliance on rules that were premised on the need to protect against harmful interference. The NPR contradicts this basic premise. The FCC is offering no empirical evidence to support an interference temperature approach. The proposed rulemaking, under the guise of testing the interference temperature concept proposed in the NOI, essentially allows unlicensed operations in licensed bands serving critical infrastructure at much higher power than currently allowed. The NPR does not propose to implement or test any interference temperature monitoring technology. AEP opposes the Commission's attempt to gather test data in a real world environment that jeopardizes the integrity of AEP's licensed systems, and places the burden, risks, and cost of testing and interference mitigation on our AEP's operations.

B. Background

AEP provides electric utility services to over 5 million U.S. customers covering 197,500 square miles in eleven states. AEP is the largest generator of electricity in the U.S., and is one of the largest investor-owned utilities in the U.S. AEP operates and maintains 39,000 miles of transmission lines and 210,000 miles of distribution circuits.

To support this infrastructure, AEP operates and maintains a sizable private communications network to support internal voice and critical control and data communications traffic. In addition, our network carries critical interconnection traffic between AEP and external neighboring entities and utilities.

AEP's private transport backbone includes hundreds of licensed microwave paths and hundreds of unlicensed, fixed point-to-point microwave paths. Our licensed microwave transmission systems fall under FCC Fixed Microwave Services, Part 101.

AEP built and maintains a private communications network in part due to economics, but largely to meet its required standards for reliability, security, and control. Vast portions of AEP's service territory are rural. It is simply not economically feasible to take service from the public network at many of these locations. The data and voice traffic that AEP's network carries is extremely important to AEP's daily operations, to the reliability of the nation's electricity grid, and to the safety and welfare of AEP's customers, employees, contractors, and the public at large. When outages occur on our electric system, our telecommunications network integrity and availability becomes even more critical. Our network must be reliable and robust, more so than the public network, because conditions (e.g., inclement weather, acts of God) that cause electrical outages tend to also cause concurrent outages to public communications networks. It is during those outages that our communication system needs to be operating normally.

Service restoration depends on reliable communications. Voice dispatch, SCADA, and mobile data are critical elements of service restoration.

Protective relay systems automatically identify and isolate fault conditions, protecting the rest of the grid from the fault, preventing outages and blackouts. Those systems must operate reliably and swiftly (in milliseconds) to protect equipment (e.g., substation transformers), conductors, and busses from damage and to prevent widespread and cascading outages. These protective relay systems must have a reliable communication path at all times, and especially under fault conditions, to operate correctly.

Data integrity and security, though always important, have become even more critical in light of recent world events impacting the security and reliability standards in our industry. In addition to security of physical assets, AEP is greatly concerned with the security and integrity of our data, communications, and information networks.

AEP's 800 MHz trunked radio system is a vital component of its communication network, and the trunked radio system could not function without the 6 GHz fixed microwave links that serve as its central nervous system. The 800 MHz system covers our entire service territory, and is the backbone of day to day communications between our distribution and transmission crews and their dispatchers. In addition, the 800 MHz system carries mobile data traffic. The common platform enables all of our users to communicate with each other throughout our service territory. When AEP is in a service restoration mode, we can bring internal crews from any location on our system to give mutual aid to our local crews.

The 800 MHz system must be reliable to ensure the safety of our crews and of the public. But this system only can function reliably if the 6 GHz private microwave paths that link AEP's 800 MHz tower sites in a WAN operate free from harmful interference. A break in the communications chain can cause problems that can ripple throughout the system.

C. The NOI and NPR Lack Interference Mitigation Provisions

The current rules are designed to protect licensees such as AEP against harmful interference. The rules proposed in the NPR would replace this system with a risky alternative structure that is based on unproven theories and that provides no safety net in the event that interference does occur.

The Commission has not proposed in the NPR that unlicensed transmitters be capable of shutting down immediately if they interfere with licensed transmissions; there will be no interference temperature monitoring/feedback network. Even if such mechanisms were in place, as discussed below, the unlicensed transmitter could interfere with licensed paths in a manner that would be undetectable from any location other than that of the licensed receiver.

The Commission asks how noise temperature limits should be enforced, and whether technology has progressed to the level that the limits could be self-enforced by the radio emitters. Technology has absolutely not progressed to the point that limits could be self-enforced by the radio emitters. They would first have to be able to detect that they are causing a problem, which they cannot. Enforcement should involve humans, and cannot be left to the (potentially) offending technology. Licensees supporting critical services must have a method of recourse, particularly when dealing with unlicensed interfering entities.

D. Interference Monitoring Network Unfeasible

The Commission proposes three potential methods for adaptive or real-time interference temperature feedback control in the NOI: 1) Measurement and response within an individual device; 2) Licensed path receivers measure interference temperature, communicate with a central site, which computes temperature and provides (broadcasts) feedback to transmitters in region; or, 3) Establish a grid of monitoring

receivers that computes temperature profiles and broadcasts data or instructions to transmitters. None of these methods is reasonable or feasible to deploy. Regarding methods 1 and 3, we question how any monitoring system, whether within the individual unlicensed device or a grid of receivers, could accurately measure or predict the interference and noise present at a foreign fixed receiver operating with a high gain directional antenna. Regarding method 2, even if the technology existed to measure interference temperature at the licensed receiver, we dispute that a central system could accurately predict or calculate the additional contribution from allowing unlicensed entities to transmit at the levels suggested in the NOI and NPR. We are not interested in funding a monitoring network and bearing additional equipment costs to deploy a network that will quite possibly cause harmful interference and therefore reduce the reliability of our licensed systems.

Even if these obstacles could be overcome, it is unclear what frequencies could be used to establish a reliable monitoring network. For example, mass media transmissions, such as FM radio subsidiary communications authority (SCA) subcarrier, do not cover significant portions of AEP's service territory, which includes rural, mountainous regions, and in any event are frequently unavailable.

Coverage issues, moreover, could prevent a monitoring network from operating effectively. For example, short of taking the extraordinary step of establishing a satellite network, it would be difficult, if not impossible, to reach unlicensed devices located in a valley surrounded by mountains. And it is not reasonable to expect a monitoring station on every peak in a mountainous region, but AEP is obligated to serve rural, mountainous areas and needs radio communications into those same areas.

Regardless of which monitoring technique is used, interference temperature is not a practical approach when applied to a fixed point-to-point application in a rural region devoid of existing licensed services. When a new licensed receiver site is slated for an area with no existing services, the interference temperature will be impossible to predict. In hilly or mountainous terrain, moreover, the receivers which

are designated to measure the interference temperature in the area may be shielded from interference that would have a catastrophic impact on a receiver located on a nearby peak.

E. Recognition and Exemption of Critical Traffic

AEP operates fixed microwave services in the 6525-6700 MHz band under Part 101 of the FCC's regulations. Our business includes transportation (e.g., coal barges), but we are primarily a regulated electric utility, providing and maintaining a large and important element of our country's critical infrastructure. We offer this discussion to bring to the Commission's attention critical facts regarding incumbent operations in the test bands proposed in the NPR (paragraph 36, *Incumbent Operations in the Proposed Bands*).

We believe that the Commission should enact, maintain, and enforce rules and policies that protect critical infrastructure licensees from harmful interference. As discussed elsewhere in these comments, we fail to see how allowing unlicensed operators into our band can have no detrimental effect. They will decrease our fade margins and reduce our availability. The FCC should consider the criticality of a band's traffic before opening a band up to unlicensed operators.

Since real time adaptation based on actual RF environments has not been done in the past, the Commission should encourage and allow the academic world to study, test, and prove this concept before transitioning to it or testing it in existing occupied spectrum bands. If the Commission insists on testing this approach within frequency bands where a significant number of incumbent systems exist, they should not choose a band containing critical infrastructure frequencies. If testing must be done on a working band, which we oppose, an unlicensed band would be more appropriate.

We appreciate the Commission's desire for general and simple metrics to gauge the effects and success of the introduction of the interference temperature concept into a frequency band. Unfortunately, this is not a simple concept, nor would it be a simple transition. The concept should be thoroughly researched, proven, and tested in a controlled, non-commercial environment prior to any discussion of implementation in active frequency bands.

F. Cost Issues

Funding for interference temperature monitoring systems should come from the parties that benefit. This includes unlicensed operators and manufacturers of unlicensed equipment, but does not include operators of licensed systems.

AEP cannot accurately estimate the costs of establishing an interference temperature. If the Commission does not force the benefiting entities, the unlicensed equipment manufacturers and the unlicensed users, to absorb the costs, it would be unfair to have existing licensees bear these costs. If the Commission requires each receiving device to contain interference temperature measurement and response technology, then licensees will definitely be forced to absorb increased equipment costs. We expect the equipment manufacturers' research and development costs, along with their increased engineering and production costs, to be passed along to their customers.

Noise floor estimates, as an alternative to continuous direct measurement and monitoring, would not be accurate and therefore would not protect incumbent licensees. The Commission is correct; measuring and monitoring the noise floor is a substantial, time-consuming, and resource intensive undertaking that cannot be done cost effectively. We urge the Commission to balance the potential benefits against the costs, given the current state of technology. We ask that the Commission consider not only the potential benefits to unlicensed operators, but also the risks and costs to incumbent licensees.

G. The NPR Lacks Technical Merit as Applied to 6525-6700 MHz Band

AEP has experienced harmful interference from other unlicensed operators in our 5.8 GHz unlicensed receivers. We believe that higher power unlicensed operations in the 6525-6700 MHz band, as proposed in the NPR, will result in similar interference.

AEP operates hundreds of fixed, unlicensed microwave paths. A great many are operated around 5.8 GHz, very near the 6 GHz licensed band. We use the same type of relatively large, directional, high gain antennas for our fixed unlicensed operations as we do for our fixed licensed operations. The unlicensed feedline systems are virtually identical to those of the licensed systems. The relatively large, directional, high gain antennas are not necessarily effective in preventing harmful interference in our fixed, unlicensed systems. Though fixed point-to-point systems are often located in isolated areas, we have found that we can expect other operators to be located in the same location as our systems. In rural, mountainous regions, there is often one location where all operators are collocated. Many operators collocate on each other's towers. There are often "nests" or "antenna farms" of towers adjacent to one another. And this phenomenon is not restricted to rural, mountainous regions. Many jurisdictions have imposed limits and restrictions on tower sites. With the advent and proliferation of cellular technology in the last decade or so, numerous entities are placing fixed systems into service to backhaul and network their wireless sites. We often find that our systems are located adjacent to one another and parallel to one another. We therefore disagree that path geometries can be assumed to be divergent, that the separation distance between a fixed, point-to-point receive antenna and an unlicensed device would typically be separated by over 100 meters, or that new, unlicensed paths would primarily be ground based. Enough of the new unlicensed devices would be fixed, located near, and aligned with fixed, licensed systems to cause substantial cases of harmful interference.

Sound engineering judgment suggests that allowing higher power unlicensed emissions in licensed bands will cause unlicensed devices to proliferate and will have a detrimental impact on the incumbent licensees. Extensive research and testing, therefore, should be performed by equipment manufacturers and academia before the Commission allows unlicensed operators to jeopardize licensed transmissions. AEP's experience in the 2.4 GHz and in the 5.8 GHz unlicensed bands demonstrates that caution is warranted. We have experienced extensive interference to our fixed paths employing high gain, directional antennas throughout our eleven state service territory.

Terrestrial fixed operations such as ours are designed with signal margins to achieve the availability required by our data, industry, and customers. Our definition of "satisfactory operation" may differ greatly from the FCC's. Our systems are subject to path fading, but are designed with sufficient signal margins to maintain availability at acceptable levels. Lowering our margins and interference threshold is not acceptable. It is not possible for an unlicensed device, especially a mobile one, to measure the ambient fixed signal levels at its receiver location and have any intelligence about the affects of its transmitter on fixed, licensed receivers at some other location. For example, an unlicensed receiver in a valley may measure little interference temperature at its location, and allow its transmitter to transmit omnidirectionally, which could then interfere with the fixed operators at nearby higher elevations. In a case such as this, the unlicensed transmitter could be equipped with dynamic frequency selection (DFS) and/or transmit power control (TPC), but they would be of no use in preventing the unlicensed operator from transmitting and potentially interfering with a licensee.

We therefore dispute the contention that the incumbent operators in the FS band at 6525-6700 MHz can tolerate an expansion in the quantity of and power transmitted by unlicensed operators in this band, even if they deploy DFS and/or TPC. We contend that we could suffer harmful interference, and that it is not appropriate to jeopardize the critical infrastructure we serve in this band.

The Commission contends that fixed operations, by their inherent static nature, are well defined and subject to simplification. The Commission contends that several reasonable assumptions apply, and it is based on those assumptions that the Commission proposes allowing greater unlicensed operation in the fixed 6525-6700 MHz band, among others. As stated above, we disagree with any assumption of minimum separation distances and off-axis locations between unlicensed operators and fixed licensed operators. We do not believe the Commission's assumptions are conservative; they are, in fact, invalid assumptions. They are far from representing worst case conditions.

Specifically, the link budget analysis proposed in the NPR is invalid since it is based on an unlicensed emitter separated by 100 meters from a fixed receiver. As discussed above, this large separation distance is not a practical assumption. It could be very little, in reality. The Commission also contends that fixed microwave systems are made robust by employing advanced modulation techniques and error correction codes to avoid harmful interference. This is true, but the Commission incorrectly assumes that those mitigation techniques alone can prevent interference. By existing rules, licensees are protected from harmful interference by a frequency coordination study. Because the path is guaranteed to be devoid of interference by in-band transmissions, the licensee can design a path in an economical manner to provide the requisite availability. Because of the directionality and high gain of the antenna system, and because of the discrimination, modulation, and error correction of the receiver, the signal level of the desired receive signal is not required to be strong. Allowing unlicensed transmissions at higher power levels could easily result in overdriven receivers and demodulators, and ultimately in harmful interference. The origin of the interfering signal could be far off axis, or far from either end of the fixed path. A fixed system employing high gain, directional antennas, is in fact very susceptible to interference, if unlicensed in-band transmissions are allowed in the vicinity. The Commission's assumptions to the contrary are simply erroneous.

H. Impact of Interference Temperature Model on Certain Existing Unlicensed Services

The interference temperature model that the Commission has proposed for unlicensed devices is inconsistent with the manner in which fixed unlicensed devices operate. For example, lowering power, switching frequencies, scanning before transmitting, or ceasing to transmit are not reasonable for fixed, point-to-point unlicensed applications, because devices of this type are locked in and transmitting at all times.

AEP is concerned that the Commission might expand the interference temperature model to unlicensed bands, such as those at 2.4 GHz and 5.8 GHz, that AEP uses extensively. The availability of this technology has had a tremendous positive impact on our design options. This relatively inexpensive technology allows AEP to reliably and privately tie remote facilities (such as 800 MHz trunked radio sites, substations, offices, service centers, and power plant support facilities) to our internal network's backbone. Requiring these devices to operate in accordance with an interference temperature model would effectively eliminate them as an option for AEP and many other users.

I. Conclusion

Without extensive research, one cannot say for sure that the rise in the noise floor expected as a result of an interference temperature approach would not cause harmful interference. Therefore, we ask the Commission to act responsibly and conservatively and to preserve the integrity of its licensed bands.

As stated previously, it is not feasible or desirable to introduce the interference temperature approach in selected bands without real time noise floor/interference monitoring for experimental purposes. It is especially not desirable for the incumbent licensees in the FCC's proposed bands and to the critical

infrastructure served by these bands. Any future interference temperature limit should be set to a safe harbor level that would constitute less than harmful interference; not at the "harmful interference" level.

The portion of the 6525-6700 MHz band allocated for Fixed Microwave Services under Part 101 of the FCC's regulations contains licensees, such as AEP, that support critical infrastructure in the United States. The FCC should exclude the frequencies held by these licensees from interference temperature testing. Live testing should only be considered if it is absolutely necessary. If so, it should be done in a controlled, laboratory environment, either by stakeholders such as equipment manufacturers, or by neutral parties such as universities. It should be initially applied to unlicensed bands. In short, power system reliability, which is critical to public safety, security, health, and well being, is dependent on communications system reliability. Critical infrastructure communication systems are too important to assume the risk involved with allowing unlicensed operators to share frequencies with licensees. The interference temperature approach to interference mitigation is a theoretical, unproven concept. The margins that exist between allowable licensed transmit power and unlicensed emissions in the same band ensure reliability for the licensees. An ad hoc increase of allowable unlicensed emissions will undoubtedly have a detrimental effect on licensees and leave the licensees with little recourse in the event of harmful interference caused by unlicensed operators.

Respectfully submitted,

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